CE 511: Dynamics of Structures (3-0-0:3)

Introduction
Types of dynamic loads; Basic background of methods available and motivation for structural dynamics.

Dynamics of Single Degree-of-Freedom Structures
Dynamic equation of equilibrium; Free vibration of single degree of freedom systems; Forced vibration: harmonic and periodic loadings; Dynamic response functions, force transmission and vibration isolation; SDOF response to arbitrary functions.

Numerical Evaluation of Dynamic Response of SDOF Systems
Time domain analysis: finite difference methods; Frequency domain analysis: basic methodology.

Earthquake Response of SDOF Systems
Earthquake excitation, response history and construction of response spectra; Response spectrum characteristics, tripartite plot, and design spectrum.

Multi Degree of Freedom Systems
Dynamic equations of equilibrium, static condensation; Symmetric plan and plan-asymmetric systems.

Free Vibration Response of MDOF Systems
Un damped systems: natural modes and their properties; Numerical solution for the eigen value problem; Solution of free vibration response for un damped systems; Free vibration analysis of systems with damping.

Dynamic Analysis of Linear MDOF Systems
Introduction, modal analysis; Response-history for earthquake excitations using modal analysis; Response spectrum analysis for peak responses; Concept of Caughey damping as a general type of proportional damping
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Introduction to Dynamics of Continuous Systems
Equations of motions for axial vibration of a beam; Equations of motion for flexural vibration of a beam; Free vibration analysis- boundary value problem, Natural frequencies, Mode shapes, Orthogonality conditions, Forced vibration analysis using modal superposition method.

Introduction to a seismic analysis

Seismic Analysis Methods; Nonlinear Time History Analysis (NLTHA) Method; Elastic Dynamic Analysis (EDA) Method using Multimodal Spectral Analysis.

Text Books and references

1. *Chopra, A. K.* "Dynamics of structures: Theory and applications to earthquake engineering", PHI Ltd., 4th edition 2011.
2. *Mario, Paz,* "Structural dynamics", CBS Publishers, 1st edition 1991.
3. *Clough R.W., & Penzien, J.* "Dynamics of Structures", McGraw Hill international, 2nd edition 1993.
4. Rao, K. " Vibration analysis and foundation dynamics", Wheeler, 1st edition 1998.
5. Siniu, E. & Scanlan, R.H. "Wind effects on structures: fundamentals and applications to design", John Wiley and Sons., 1st edition 1996.
6. *Meirovitch, L.* "Elements of Vibration Analysis", McGraw-Hill, 2nd edition 1986.
7. *Wilson, E. L.* "Static and Dynamic Analysis of Structures", Computers and Structures, Inc., Berkeley, CA, 4th edition 2004.